

## FEEDING OF COBRAS IN CAPTIVITY.

BY

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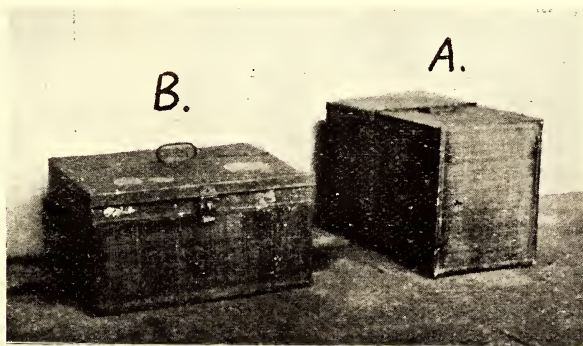
(From the Haffkine Institute, Bombay).

As regards the feeding habits of cobras in captivity, there appears to be some difference of opinion among observers. For example, Wall, in his 'Popular Treatise on the common Indian Snakes', mentions that the cobra feeds principally on rats, frogs, toads, and less frequently on birds, and that it seems to show no special preference for any of these creatures under natural conditions. In captivity, however, many specimens feed eagerly and thrive well. Nicholson, on the other hand, in his book on *Indian Snakes* maintains that he has never seen cobras in captivity feed, and unless fed forcibly they would starve themselves to death. An opportunity offered itself during this year, at the Haffkine Institute, to study the feeding habits of cobras in captivity.

An attempt has been made in this paper to record the facts observed during the course of some experiments, carried out to find the best method of feeding cobras.

### COBRAS IN CAPTIVITY AT THE HAFFKINE INSTITUTE.

Cobras are received at the Institute from far off places and are despatched in specially designed wooden boxes. As soon as the snakes arrive, they are removed from these boxes and are kept separately, each in a japanned tin box. The tin boxes in use are



Two types of cages for keeping live Snakes.

of two types. Type A measures  $52 \times 26 \times 30$  cm.; one of its sides measures  $24 \times 28$  cm. and is of wire gauze (10 meshes to 2.5 cm.) and nearly half of the top of the box forms a lid which opens and shuts by hinges. Type B measures  $45 \times 36 \times 23$  cm.; in this type the two opposite sides of the box are of wire gauze, one measuring

43 × 21 cm. and the other 43 × 15 cm. (See photograph of types A and B.)

At the time when these experiments were commenced, nearly one half of the snakes were kept in a well ventilated room on the top floor of the Institute, where plenty of air and light could be had. The rest were kept in the animal house in a small room which had no special arrangements for proper ventilation except that the two doorways of the room faced each other. The experiments were carried out during the monsoon months namely from 10th June to 15th October 1934, when the average lowest minimum temperature was about 74° F. and the total rainfall about 70". On the 1st of June 1934 there were in all 319 cobras (*Naia tripudians*), and these were obtained from the following places:—

Madras	...	268	Narasingspore	...	4
Mysore	...	19	Raibanore	...	21
Wardha	...	5	Gwalior	...	2

From June to September 1934, 131 cobras died in captivity, the mortality among these being distributed as follows:—

June	1934	...	...	58
July	"	...	...	29
August	"	...	...	22
Sept.	"	...	...	22

The records of the Colaba observatory for the corresponding dates are as follows:—

Month	Highest maximum temperature during the month	Lowest minimum temperature during the month	Total rainfall during the month
June 1934 ...	93·5°	74·7°	29·06"
July " ...	88·8	72·9	22·74
August " ...	86·6	73·9	12·14
Sept. " ...	89·0	73·5	5·83
			69·77"

The mortality among the cobras kept in the well ventilated room and in the animal house was as follows:—

Where housed	No. of Cobras on 1st July 1934	DIED			Total died	Percentage Mortality
		July	Aug.	Sept.		
Upstairs ...	113	9	12	8	29	25·7
Animal House.	148	20	10	14	44	30·0

#### EXPERIMENTS ON THE FEEDING OF COBRAS.

The methods employed for the feeding of cobras in these experiments were so devised as to obtain comparative results.

*Experiment I.* One hundred cobras were fed with live rats. The rats selected for this purpose were the Bombay *Rattus rattus*, which are sent to the Institute daily by the Municipality of Bom-

bay for the detection of plague. These rats were kept under observation for several days to ensure that they were free from any natural infection. The rats selected weighed from 30 to 70 grams; and according to the size of the cobra the weight of the rat used varied. A live rat was dropped into the cage of each cobra. After 24 hours it was noticed that only 27 cobras had swallowed the rats. Fifty-five rats were killed but not eaten, and these were removed from the cages as they began to decompose. Eighteen rats were found alive although they had been with the cobras for 24 hours; and some of these were removed from the cages. It was also noticed that the rats which were left alive in the cages for longer periods continued to live for a period of five days; during this period, driven by hunger, they started to nibble at the cobras, and therefore they had to be removed.

During the course of this experiment it was noticed that when a cobra struck at a live rat, the rat died within one and a half to three minutes. In no case did the survival period exceed four minutes. When the cobra saw its prey dead, it commenced to swallow it by working its teeth and lower jaw until the prey was gradually forced in, and in about three minutes the entire rat disappeared from view. During the process of swallowing the epiglottis was often projected forwards to take in air and thus prevent suffocation. Also during the process of swallowing the whole body of the cobra remained stationary; but immediately the prey disappeared down its throat, the cobra began to make a somewhat circular movement and within a very short time (about three minutes) the prey reached its destination, namely the region of the stomach. This circular movement was repeated over and over again at intervals of a few minutes. After about half an hour the cobra retired to a corner of the cage and remained coiled up. It was observed that before retiring to the corner the cobra made peculiar movements suggesting that it was searching for something. It was thought that this might be a drink of water. So a plate full of water was introduced into the cage. The cobra drank very freely and since then the practice of giving water to the cobras after each feed has been continued. In these experiments it was noticed that it took on the average five days for a cobra to digest a live rat.

*Experiment II.* One hundred cobras were fed on dead rats. These rats were killed by drowning in a pail of water and were immediately placed in the cages. Only 28 cobras swallowed the rats.

*Experiment III.* One hundred cobras were given about 30 grams each of minced beef bought fresh. In only 18 cases did this method of feeding prove successful.

*Experiment IV.* Next a whole hen's egg was placed in each of 25 cages. The snakes did not seem to take notice of the eggs and all the eggs remained entire even after five days.

*Experiment V.* One hundred cobras were fed as follows:—Rats were killed by drowning and were cut in two longitudinally and all the internal organs removed. From 30 to 50 grams of this cut-up meat were placed in each of the hundred cages. Thirty-seven cobras fed successfully by this method.

It was also noticed that when a cobra failed to swallow the cut-up meat within three hours of its being offered, it very rarely ate; and only in a very few cases was this meat eaten up to within six hours. In all these experiments the food left uneaten was removed after 24 hours of its introduction into the cages. It was observed that a cobra took three days to digest a cut-up rat.

During the experiments it was observed that all the cobras did not behave alike with regard to their feeding. According to their feeding behaviour they can be divided into three groups.

*Group 1.* Those that refused to feed at all. The behaviour of cobras Nos. 313 and 329 in the following table are cited as examples to illustrate this.

COBRA 313				COBRA 329			
30-6-34	...	L	—	27-6-34	...	L	—
3-7-34	...	L	—	30-6-34	...	L	—
19-7-34	...	D	—	2-7-34	...	C	—
31-7-34	...	M	—	20-7-34	...	C	—
1-8-34	...	C	—	31-7-34	...	M	—
10-8-34	...	C	—	1-8-34	...	C	—
20-8-34	...	C	—	10-8-34	...	C	—
30-8-34	...	C	—	20-8-34	...	C	—
10-9-34	...	C	—	30-8-34	...	C	—
				10-9-34	...	C	—
				14-9-34	...	L	—

Note: (—) Means refused to eat.

L means Live rat;  
D „ Dead rat;  
M „ Meat;  
C „ Cut-up rat.

*Group 2.* Those that fed upon rats in any form—whether alive, dead or dissected, and on meat (beef). The behaviour of cobras Nos. 321 and 372 in the following table are cited as examples to illustrate this.

COBRA 321			COBRA 372		
2-7-34	L	*	27-6-34	L	*
19-7-34	D	*	6-7-34	D	*
31-7-34	M	*	20-7-34	C	*
10-8-34	C	*	1-8-34	C	*
20-8-34	C	*	7-8-34	M	*
30-8-34	C	*	22-8-34	C	*
10-9-34	C	*	3-9-34	C	*
			14-9-34	C	*
			15-9-34	L	*
			18-9-34	L	*
			19-9-34	L	*
			20-9-34	L	*
			21-9-34	L	*

Note: \* means positive feeding or fed successfully.



Group 3. Those that preferred only one type of food either a live rat or a dissected one. (a) The behaviour of cobras Nos. 29 and 115 in the following table illustrates the results obtained with dissected rats.

COBRA	29	
23-6-34	L	—
26-6-34	L	—
9-7-34	D	—
25-7-34	C	*
3-8-34	C	*
13-8-34	C	*
25-8-34	C	*
4-9-34	C	*
19-9-34	C	*

COBRA	115	
19-6-34	C	*
2-7-34	L	—
9-7-34	D	—
14-7-34	L	—
25-7-34	C	*
7-8-34	C	—
17-8-34	L	—
27-8-34	C	*
10-9-34	C	*
21-9-34	C	*

(b) The behaviour of cobras Nos. 18 and 220 in the following table illustrates the results obtained with live rats.

COBRA	18	
26-6-34	L	*
9-7-34	D	—
25-7-34	C	—
3-8-34	C	—
13-8-34	L	*
25-8-34	C	—
4-9-34	L	*
11-9-34	L	*

COBRA	220	
23-6-34	L	*
16-7-34	D	—
27-7-34	C	—
7-8-34	M	—
13-8-34	L	*
17-8-34	C	—
30-8-34	C	—
4-9-34	L	*

The following table shows the combined results obtained by the various methods employed for the feeding of cobras from 16-6-1934 to 25-7-1934.

Methods of feeding cobras with	No. of observations made	Percentage of successful feedings
Live rats ...	200	25
Dead rats (drowned) ...	200	24
Dissected rats ...	195	37
Beef meat ....	200	15

Since then *over one thousand observations* have been made with dissected rats, and the results have shown the average percentage of successful feedings by this method to be 33.

The snakes that refused to feed had to be forcibly fed. The method employed at the Institute prior to these experiments, consisted in pouring down the gullet of the cobra a mixture of egg and milk. On an average each cobra received about 30 cc. of egg content and 40 cc. of milk. When this was given it was observed that about 33 per cent of cobras thus fed vomited almost the entire quantity within 5 to 15 minutes of their feeding. Therefore a change was made in the mixture by increasing the amount of egg content to 45 cc. and decreasing the quantity of milk to 20 cc. By employing this method it was observed that only about 10 per cent of the cobras vomited after feeding.

#### MORTALITY AMONG COBRAS AND ITS RELATIONSHIP TO FEEDING.

As most of the deaths among the cobras were due to starvation, the results of these feeding experiments with special reference to mortality among cobras have been arranged under four groups.

*Group 1.* In this group are included all those cobras that fed successfully each time they were supplied with food. During the course of this experiment nine attempts were made at feeding each cobra with dissected rats. Among the 33 cobras thus fed, there was not a single death until the 15th October 1934 (the period of starvation).

*Group 2.* In this group of 68 cases, most of the feedings were successful. During the period of observation 10 died giving a percentage mortality of 14.7.

If groups 1 and 2 are combined they give a percentage mortality of only 10.

*Group 3.* In this group are included those cases where the cobras fed only once and then refused to feed when six or seven attempts at feeding them were made. Out of 17 cobras 9 died with a percentage mortality of 53.

*Group 4.* All the 160 cobras in this group did not feed at all of their own accord and therefore had to be forcibly fed with egg and milk. The number of deaths in this group was 80 giving a percentage mortality of 50.

If groups 3 and 4 are combined they give a percentage mortality of 50.3.

The above results seemed to indicate that the method of feeding cobras in captivity with dissected rats was not only attended with a larger percentage of successful feedings, but was quite safe since there was not a single death (during the period of five months' observation) among the cobras thus fed, thus showing that there was not appreciable injury caused by the swallowing of exposed bones in the dissected rats.

#### THE FREQUENCY WITH WHICH COBRAS COULD FEED.

During the course of these experiments an attempt was made to study how much and how often a cobra would feed. Wall relates instances regarding the voracious nature of some snakes in

captivity. This was found to be the case with some cobras as the following table well illustrates.

Case No.		17-9-1934	18-9-1934	19-9-1934	20-9-1934	21-9-1934	22-9-1934	23-9-1934	24-9-1934	25-9-1934	26-9-1934	27-9-1934	28-9-1934	29-9-1934	30-9-1934	1-10-1934	2-10-1934	3-10-1934	4-10-1934	5-10-1934	6-10-1934	7-10-1934	8-10-1934
390	...	...	*	*	*	-	-	.	-	*	*	*	*	.	.	.	*	*	*	*	.	.	*
391	...	...	*	*	*	-	-	.	-	*	*	*	*	.	.	.	*	*	*	*	.	.	*
392	...	...	*	-	-	*	-	.	*	*	*	*	*	.	.	.	-	-	-	-	.	.	-
397	...	...	*	-	-	*	-	.	-	*	-	-	-	.	.	.	*	-	-	-	.	.	*

*Note.*—\* means positive feeding;  
 - „ negative feeding or not fed;  
 . „ feeding not carried out.

From 25-9-1934 to 8-10-1934, cobras 390 and 391 fed almost on all successive days, the break in daily feeding being unavoidable on account of holidays.

#### RELATION BETWEEN FEEDING AND THE YIELD OF VENOM.

Dowsett mentions that snakes in captivity lose the greater part of their venom. Experiments carried out here did not support this view.

The method employed at the Institute was that as soon as the cobras were received, their venom was extracted and then they were forcibly fed with a ration of milk and eggs. Afterwards they were fed periodically and venom was extracted at intervals of two weeks.

*Experiment VI.* Between July 12th and July 25th, 1934, on first extraction an yield of 34·680 grams of dry venom was obtained from 233 cobras, giving an average of 0·149 grams per cobra. The venom was dried over calcium chloride in vacuo.

At the second extraction between July 26th and August 11, 1934, of the above group, out of which 6 had died during the interval, 36·270 grams of dry venom was obtained from 227 cobras, giving an average of 0·160 grams per cobra.

At the third extraction between August 14 and September 20, 1934, the above group, out of which 22 had died, gave 40·445 grams dry venom, showing an average yield of 0·198 grams per cobra.

From 8th to 27th September, 1934, experiments were carried out with two groups A and B, each of which consisted of 50 cobras.

*Group A*, consisting of cobras which regularly and successively fed on rats, yielded 12·020 grams dry venom, whereas

*Group B*, comprising cobras which refused to feed and had to be forcibly fed, yielded 8·275 grams dry venom.

This showed that cobras when properly fed, especially with rats, yield an increased quantity of venom.

In another group of 36 snakes which were received at the Institute as follows:—

November 1933	...	...	...	...	11
December	...	...	...	...	7
January 1934	...	...	...	...	4
March	...	...	...	...	10
April	...	...	...	...	1
May	...	...	...	...	2
June	...	...	...	...	1

the total venom yield on *first extraction* was 6·247 grams. These snakes were feeding regularly and the extraction of the venom took place at regular intervals of 2 to 3 weeks. The total venom on final extraction in September 1934 was 8·105 grams. All cobras in this group were fed successfully with rats.

Yet in another group, 31 cobras were forcibly fed on milk and egg. They were received at the Institute as under:

November 1933	...	...	...	...	9
December	...	...	...	...	10
March 1934	...	...	...	...	10
April	...	...	...	...	2

On first extraction they gave 7·305 grams dry venom and finally in September 1934 they yielded only 6·485 grams.

All the above experiments seemed to indicate that proper feeding increased the quantity of venom or at least kept up to the initial yield.

In the course of these experiments the maximum yield of fresh venom which was obtained from one cobra was 1·750 grams and from another the minimum yield was 0·040 grams.

The maximum yield of dry venom was 0·530 grams and the minimum 0·010 grams.

Some interesting observations were made during these experiments. These are (1) cobras thrive when housed in a dry and well ventilated room; (2) they drink water freely after a feed; and (3) black cobras are the easiest to feed.

#### SUMMARY.

1. Feeding cobras in captivity with dissected rats gave the largest percentage of positive or successful feeding. This method was found to be quite safe.

2. In some cases it seemed necessary to feed cobras with dissected rats as well as with live rats.

3. At times cobras exhibited individual idiosyncrasies and it was necessary therefore to feed them on that type of food which they preferred.

4. With cobras which fed well in captivity the yield of venom during one year compared favourably with that obtained when the cobra arrived first at the laboratory.

5. Even from starving cobras a certain amount of venom could be collected till their death.

6. A cobra took about three days to digest a dissected rat and about five days to digest a live rat.



7. As regards the time when cobras should be fed it appeared that, when extraction of venom was attempted, they were best fed with dissected rats once in ten days and venom extracted after seven days from the time of the feeding, as immediately after a feed the yield of venom became considerably less. At least an interval of three days seemed necessary between the extraction of venom and the next feed.

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